

Session: Conflicting Pressures in a Statistics Department - A Panel Discussion.

PRESSURES FOR AND AGAINST EFFECTIVE TEACHING

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Abstract

Teachers are synthesized as a result of many, many factors and influences. The growth or deterioration of a teacher is a continuing process extending over the lifetime of a teacher. Some of the factors for effective or for ineffective teaching are (i) personal characteristics, (ii) tradition, (iii) peer pressure, (iv) mathematical orientation, (v) computing orientation, (vi) maturity and experience, (vii) course load, (viii) tenure credits, (ix) ways of measuring effective teaching, (x) any many more. Each of the above items can contribute negatively or positively to effective teaching.

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## 1. Introduction

In discussing conditions, traits, and pressures for effective teaching, one could follow many approaches. However, in all approaches, one should first define "effective teaching". We shall use a very simplistic definition, viz., effective teaching is considered to be maximum student assimilation of the subject matter of a course, within the constraints of credit hours and work load requirements, and ranges from zero to complete assimilation of material. Students should not finish a course with disgust, anger, or loss of interest if the teacher is effective. After presenting an acceptable definition of effective teaching, one could follow the approach of Vandemark (1979) in his discussion of the synthesis of a scientist. Or, one could follow the approach of one of the authors listed in his references. We have taken a somewhat different approach and considered a number of contributing conditions or characteristics which contribute to effectiveness in teaching. The items discussed are personal characteristics, tenure, course load, peer pressure, tradition, mathematical orientation, and computing orientation. We also consider some ways to measure teaching load and teaching effectiveness.

## 2. Personal Characteristics

The totality of personal characteristics of a teacher has its effect on effectiveness of teaching. It would be impossible to rank personal characteristics because a characteristic, seemingly unrelated to teaching, may so distract students that they are unable to learn despite the fact that all other desirable characteristics are present. For example, a truly remarkable, well-organized

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well-prepared, and excellent lecturer may be one hour early to one hour late in arriving to present his scheduled lecture. Despite this dilemma, we all know that such characteristics as (i) knowledge of the subject, (ii) lecturing ability, (iii) use of teaching aids, (iv) preparation and organization, (v) out-going personality, (vi) continued growth in knowledge of the subject, (vii) personal appearance, etc., are all desirable for effective teaching. We also know that a disorganized, poorly-informed, unkempt, unmotivated, unprepared, disinterested individual will most likely be considered as a poor teacher. If there is the desire, commitment, and drive, a number of personal characteristics can be improved, thereby increasing one's effectiveness as a teacher. But, first one must recognize characteristics that require improvement, and one must be perceptive about a realistic work load for his students.

Maturity has not been discussed above, and perhaps should be discussed separately. Mostly, mature teachers should teach the introductory courses rather than having new faculty members or graduate students teach them. There is a wide-spread feeling that the more introductory the course, the less skill needed. This can lead to ineffective teaching. To illustrate, roughly one-third of statistics textbooks sent me this spring by publishers have an incorrect or garbled definition of a simple random sample or fail to give one. This is considered to be deplorable, but it exists. The incorrect definition given is "every individual (sampling unit) in the population has an equal chance of being selected". They need the words "equal and independent". Since young faculty and graduate students are often awed by some text authors they do not question the definition and teach an incorrect definition. Also, maturity often helps to present complex ideas simply.

### 3. Tenure

The present tenure system is such as to eliminate truly effective teachers who do no research. One can cite many examples where this has happened, as well as many exceptions. Quality and quantity of research efforts have a major, if not dominant, role in granting tenure in most cases and at many colleges and universities. One of the reasons is that we do not have quantitative measures

of effectiveness of teaching. Perhaps we could have graduates rank all teachers they had on a continuous scale from completely ineffective to extremely effective, and perhaps the ranking should be done one year after the student graduates. Then, a tenure-review committee would be able to use effectiveness of teaching in granting tenure. Also, the use of measures of teaching effectiveness in granting tenure has to be acceptable to administrators. Good researchers bring in grant and contract monies for research, whereas good teachers do not bring in the same magnitude of monies for teaching studies.

The fact that teaching is considered, even to a limited extent, in granting tenure, tends to make those seeking tenure pay attention to their teaching. They need to place some emphasis on their teaching effectiveness in order to move up the ranks. Sometimes after tenure is granted an individual pays little or no attention to his effectiveness in teaching. He may consider teaching as an unpleasant part of his position. Such an attitude contributes to ineffectiveness in teaching.

#### 4. Course Load

Instructors with three to five courses per term have little time for preparation and for up-dating a course. They are too busy grading papers, giving lectures, meeting students, and doing research to attain tenure. Lectures are prepared "on the way to class". With the cut-back in funds, administrations require additional course loads for faculty. One way to ease this dilemma is to use the computer to grade problems and examinations and for the bookwork associated with a course. On the other hand, one course per term may prove to be inefficient use of an instructor's time. That is, he may spend all of his time on one course and may then expect the students to do the same thing. Perhaps a better procedure would be to teach two courses in one term and then take a term off for research rather than to teach one course each term. Of course, this depends upon the individual.

#### 5. Peer Pressure and Tradition

The pressure from one's peers in a research-oriented, a probabilistic-oriented,

a hypothesis-testing-oriented, etc., organization can be detrimental to effective teaching of statistical design, statistical methods, and statistical inference courses. An individual may not be effective in teaching in the same manner as his peers, but would be more effective following his own strengths. Also, the material taught may be completely inappropriate for the students in a class. They may never use the material taught. They may need a data-analysis course rather than an introductory probability course, or vice versa.

Tradition plays an important part of teaching. Many statistical methods texts are versions of Snedecor and many probability books are versions of Feller. Textbook writers frequently show little originality, and publishers even less. The latter want books that deviate little from the best seller in the field. A teacher's professors often have considerable effect on his teaching. Teaching "just like granddaddy did" is not always appropriate, despite students' tendency to teach in the same manner in which they were taught.

On the other hand, emulation of a peer or past teacher who was excellent and whose methods are adaptable to one's teaching may be very useful in contributing to one's teaching effectiveness.

## 6. Mathematical Orientation

A teacher who is interested in the mathematics of statistics and in mathematical manipulation per se can be very effective in a course on the mathematics of statistics, but can be a disaster in teaching statistical design or methods. In most cases, mathematicians are incompetent to teach statistical design, methods, and/or inference. They do not, however, feel that they are incompetent. Likewise, a probabilist, a design combinatorist, or a matrix manipulator may be very ineffective in teaching modelling, statistical planning, statistical methodology, data analysis, or statistical inference.

## 7. Computing Orientation

There are a number of computer-oriented individuals who appear to feel that the major part of statistics has to do with computing. They want all statistics courses to use the computer (pocket, desk, mini, micro, or macro) in their courses.

Some administrators are also of this nature. The computing aspects of statistics is often the easiest part to teach. The planning and inference parts of statistics may be by far the most difficult. It should be noted that statistical methods and so-called "experimental design" books devote the major share of their pages to computing. A mathematician, a probabilist, an economist, a sociologist, or a computer scientist has little difficulty in teaching the computing aspects, but he often omits the planning, use, and inference parts of statistics. Most books with the words "experimental design" or "design of experiments" in their title have little or nothing on the planning of investigations.

It should be noted that any time devoted to computer programming and computer usage must be compensated for by being able to teach more statistics. The omission of statistical planning, methods, and/or inference aspects to teaching computing makes for ineffective teaching in statistics.

#### 8. Ways of Measuring Teaching Load and Effectiveness

For an administrator, teaching load should not be calculated solely on the amount of time one devotes to a course. A person teaching one course per term and spending full time on the course is not an expeditious use of personnel. Most universities cannot afford such luxuries. One method used to measure load is to multiply the number of credits times the number of students to obtain student credit hours. This measure is not useful for measuring teaching load because one professor teaching 100 students does not devote 10 times the effort of a professor teaching 10 students. Some measures that might be more appropriate are:

- (i)  $(\text{credit hours} \times \text{number of students})^p$ ,  $\frac{1}{2} \leq p \leq 1$ ,
- (ii)  $\text{credit hours} + \log(\text{constant} + \text{number of students})$ ,
- (iii)  $\text{credit hours} + (\text{constant} + \text{number of students})^p$ ,  $\frac{1}{2} \leq p \leq 1$ .

For the above example, three credits, a constant of 25, and  $p = \frac{1}{2}$ , (iii) would give  $3 + (25 + 100)^{\frac{1}{2}} \doteq 14$  and  $3 + (25 + 10)^{\frac{1}{2}} \doteq 9$ . Thus, the professor with 100 students would have about a 55% heavier teaching load than the professor with 10 students. This manner of computing relative teaching loads would be more realistic than (i) for  $p = 1$ , which is in current use.

To measure teaching effectiveness, one could supply graduating seniors or graduates who graduated one or more years previously, with a list of professors and courses taken by the students and have them rate their instructors in a continuous scale from completely ineffective to extremely effective. The scale could be graduated from 0 to 10. Then, the ranks of all students of a teacher could be averaged. Some arguments can be put forward for having one year or longer graduates rank teaching effectiveness. However, the difficulties of reaching these graduates may necessitate using graduating seniors. It would probably be undesirable to use an administrator or one's colleagues for rating a teacher's effectiveness.

Some acceptable, realistic measure of teaching load would be useful to tenure review committees and administrators. Likewise, some such measure as the above may be an acceptable and useful measure of teaching effectiveness. A teacher would know his rating and could take steps to improve it.

#### 9. Reference

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